
920 SCHOOL CROSSWALKS

The purpose of this section is to establish a uniform procedure of evaluating the need for school crosswalks.

920.1 SCHOOL CROSSWALK WARRANTS

A. Average Time Between Gaps Warrant	Maximum	10 Points
B. School Age Pedestrian Volume Warrant	Maximum	10 Points
C. 85th Percentile Approach Speed Warrant	Maximum	5 Points
D. Average Demand Per Gap Warrant	Maximum	<u>8</u> Points
Maximum Total Points		33 Points

The minimum warrant for the installation of a marked school crosswalk is satisfied when a location rates at least two points for school age pedestrian volumes and has an overall total of at least 16 points in an urban area or 12 points in an isolated community of under 10,000 population (rural). A School Crosswalk Warrant Evaluation Form is provided in Figure 920-A.

A. Average Time Between Gaps

Point assignment is based on gap measurements taken during the evaluation period.

<u>Average Minutes Between Usable Gaps in Traffic</u>	<u>Points</u>
less than 1	0
1.01-1.25	2
1.26-1.67	4
1.68-2.50	6
2.51-5.00	8
over 5	<u>10</u>
Maximum	10

B. School Age Pedestrian Volume Warrant

Points are assigned in accordance with the total number of school age pedestrians crossing at the study location on the way to or from school during

the evaluation period. A school crossing shall not be installed where the school age pedestrian volume is 10 or less.

School Age Pedestrian Volume		
<u>Urban</u>	<u>Rural</u>	<u>Points</u>
10 or less	10 or less	0
11-30	11-20	2
31-50	21-35	4
51-70	36-50	6
71-90	51-65	8
over 90	over 65	<u>10</u>
Maximum		10

C. 85th Percentile Approach Speed Warrant

Points are assigned in accordance with the vehicular approach speed from both directions of travel as determined through engineering speed studies. No school crosswalks shall be installed on roadways having 85th percentile operating speeds in excess of 45 mph.

Approach Speed	
<u>mph</u>	<u>Points</u>
under 20	0
20-25	1
26-30	2
31-35	3
36-40	4
41-45	5
over 45	<u>0</u>
Maximum	5

D. Average Demand Per Gap Warrant

Points are assigned in accordance with the average number of demands per gap during the evaluation period. Since school children frequently walk in groups, the arrival of each individual, or group, at the crossing location should be construed as one demand, i.e., the arrival of a group of three, one individual, a group of two, and another individual constitute four demands.

<u>Average Demand Per Gap</u>	<u>Points</u>
1 or less	0
1.01-1.67	2
1.68-2.33	4
2.34-3.00	6

over 3.00 8

Maximum 8

920.2 FORMULAS

$$(1) \text{ School Age Pedestrian Crossing Time} = \frac{W}{3.5} + 3 + 2(N - 1)$$

$\frac{W}{3.5}$ = crossing time in seconds (critical width in feet of the pavement to be crossed divided by the assumed juvenile pedestrian walking speed of 3.5 feet per second).

3 = pedestrian perception and reaction time (the number of seconds required for a child to look both ways, make a decision, and commence to walk across the street).

$2(N - 1)$ = pedestrian clearance time (additional seconds of time required to clear the largest observed group of children from the roadway). The children are assumed to cross the roadway in rows of five with two-second time intervals between each row. The clearance time interval is equal to $2(N - 1)$ where N is the number of rows, 1 represents the first row, and 2 the time interval between rows.

$$(2) \text{ Trial Usable Gap} = W + 3$$

$$(3) \text{ Average Minutes Between Gaps} = \frac{\text{Length of Evaluation Period in Minutes}}{\text{Number of Usable Gaps}}$$

$$(4) \text{ Average Number of Demands Per Gap} = \frac{\text{Total Demands During Evaluation Period}}{\text{Number of Usable Gaps}}$$

920.3 SURVEY METHODS

A. Personnel Requirements: One person.

B. Duration of Survey: Forty-five minutes before school starts to 15 minutes after school starts in the morning and 30 minutes before school ends to 30 minutes after school ends in the afternoon.

C. Equipment: Stop watch and field data forms.

D. Type of Survey:

1. School age pedestrian count within the proposed crosswalk area during the evaluation period.

2. Usable gap time count during the same evaluation period.
 - a. Children may cross roadways in groups and additional seconds of time are required to clear the largest observed group of children from the roadway. Since the size of the groups is unknown until the field data collection is completed, a trial usable gap should be used for field data collection.
 - b. The trial usable gap is the curb-to-curb width of the street, in feet, plus 3. This ensures that the usable gaps measured in the field will include as a subset all of the actual usable gaps since a group size of no more than one row is assumed.
 - c. During the evaluation period, the length of each gap that is equal to or exceeds the calculated trial usable gap time is entered on the field data form in seconds.
3. Speed samples should be obtained.

920.4 USE OF THE CROSSWALK WARRANT FIELD FORMS

- A. Fill out the location information on the heading of the Warrant Evaluation form, sketch the area on the bottom of the form, compute the trial usable gap, and enter the figure (in seconds) in the appropriate space on the Warrant Evaluation form.
- B. For the duration of the survey, enter on the field data sheet the length (in seconds) of those gap times equal to or exceeding the calculated trial usable gap time. During this period also note the time at which the gaps occurred in the TIME column (this will be used to determine the gaps which occurred in the evaluation period at the end of the survey).
- C. For the duration of the survey also record the school age pedestrian volume by five-minute intervals. Individual pedestrians may be recorded by tally marks. Groups should be indicated by size (i.e., 7 for a group of seven pedestrians).
- D. After the field data is collected, the school age pedestrian crossing time (actual usable gap time) is calculated by determining the size of the largest group observed in the evaluation period and dividing by five to determine the number of rows N. Any remainder counts as one row, i.e., for a largest group size of eight pedestrians there would be 1.6 rows which would be rounded up to two rows of pedestrians. The school age pedestrian crossing time equals $W/3.5 + 3 + 2(N-1)$.
- E. Determine the evaluation period (in minutes) by finding, from the pedestrian count data, the time period during which 80% of the pedestrians crossed.

- F. The field data for the evaluation period is reviewed, and all recorded gaps that are shorter than the actual usable gap time are deleted from the data.
- G. To obtain average minutes between gaps, divide the evaluation period (minutes) by the number of usable gaps in the period.
- H. To obtain the average number of demands per gap, divide the number of demands during the evaluation period by the number of usable gaps.
- I. Record the average minutes between gaps, the school age pedestrian volume, the approach speed, and the average number of demands per gap on the Warrant Evaluation form.
- J. Evaluate the individual warrants, assign points as merited, and tabulate to determine if a marked school crosswalk installation is justified.

The location and marking of school crosswalks shall be approved by the Regional Traffic Engineer.

ARIZONA DEPARTMENT OF TRANSPORTATION INTERMODAL DIVISION TRAFFIC STUDIES SECTION SCHOOL CROSSWALK WARRANT EVALUATION			
ROUTE: _____ M.P. _____ INTERSECTION: _____ COMMUNITY: _____ DATE: _____ TIME: _____ WEATHER: _____ DISTRICT: _____ COUNTY: _____ INVESTIGATOR: _____			
TRIAL USABLE GAP $W + 3 =$	PEDESTRIAN CROSSING TIME $\frac{W}{3.5} + 3 + 2(N-1) = \frac{\quad}{3.5} + 3 + 2(\quad) =$		
MAXIMUM NO. OF USABLE GAPS $\frac{\text{TOTAL USABLE GAP TIMES DURING E.P.*}}{\text{PEDESTRIAN CROSSING TIME}} = \frac{\quad}{\quad} =$	AVERAGE MINUTES BETWEEN GAPS $\frac{\text{TIME INTERVAL (MINUTES) DURING E.P.*}}{\text{NO. OF USABLE GAPS}} = \frac{\quad}{\quad} =$		
AVERAGE NO. OF DEMANDS PER GAP $\frac{\text{TOTAL DEMANDS DURING E.P.*}}{\text{NO. OF USABLE GAPS}} = \frac{\quad}{\quad} =$			
* EVALUATION PERIOD (E.P.) = THE PERIOD WHEN 80% OF THE SCHOOL AGE CROSSING ACTIVITY OCCURS.			
EVALUATION: URBAN CONDITIONS – 16 POINTS <input style="width: 50px;" type="text"/> RURAL CONDITIONS – 12 POINTS <input style="width: 50px;" type="text"/>			
WARRANTS	FIELD DATA	ASSIGNED POINTS	MAXIMUM POINTS
1. AVERAGE TIME BETWEEN GAPS (MINUTES)			10
2. SCHOOL AGE PEDESTRIAN VOLUME (NO.)			10
3. 85 TH PERCENTILE APPROACH SPEED (KM/HR)			5
4. AVERAGE DEMAND PER GAP (NO.)			8
TOTAL			33
<div style="text-align: center; margin-bottom: 10px;"><u>SKETCH</u></div>			

FIGURE 920-A

SCHOOL CROSSWALK WARRANT EVALUATION FORM

[illegible]

FIGURE 920-B

PEDESTRIAN VOLUME AND USABLE GAP TIME FORM